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ABSTRACT

The overlap of the Wechsler Intelligence Scale for Children-Revised (WISC-R) and the Halstead-Reitan Neuropsychological Battery (HRNB) was investigated in light of their use in diagnosing children's learning problems. Scores for 1,181 children in the WISC-R and the HRNB were related using a canonical correlational analysis. One significant correlation emerged, "R" "c" = 0.64. The primary source of redundancy between measures was attributed to cognitive variables. In an effort to explore the constructs for both measures, data from the WISC-R and the HRNB were submitted to factor analysis. Six factors emerged, three of which corresponded closely to those usually reported from the WISC-R. A five-page list of references is appended. (Author/SLD)

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The WISC-R and Halstead-Reitan Neuropsychological
Battery: A Comparative Study

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Running head: WISC-R and HRNB

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WISC-R and HRNB

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Abstract

The overlap of the Wechsler Intelligence Scale for Children-Revised (WISC-R) and the Halstead-Reitan Neuropsychological Battery (HRNB) was investigated in light of their use in diagnosing children's learning problems. Scores for 1181 children on the WISC-R and the HRNB were related using a canonical correlational analysis. One significant correlation emerged, $R_c = .64$. The primary source of redundancy between measures was attributed to cognitive variables. In an effort to explore the constructs for both measures, data from the WISC-R and the HRNB were submitted to factor analysis. Six factors emerged, three of which corresponded closely to those usually reported for the WISC-R.

WISC-R and HRNB

The WISC-R and Halstead-Reitan Neuropsychological Battery: A Comparative Study

A number of investigators have examined the value of intellectual and more specialized neuropsychology measures in assessing neurologically impaired children (Black, 1976; Gaddes, 1975; Golden, 1978; Klonoff, Robinson, & Thompson, 1969; Luria, 1963, 1966; Rourke, 1976). For instance, Boll (1974) and Klonoff and Low (1974), demonstrated the value of the Wechsler Intelligence Scales for Children (WISC) in concert with the Halstead-Reitan Neuropsychology Battery (HRNB) when predicting neuropsychological impairment. In the Klonoff and Low (1974) study, the overlap between the WISC and the HRNB for groups of brain damaged and normal children was examined. When the variability attributed to intelligence was removed, many, but not all of the differences between the two groups were eliminated. On the basis of this data, Klonoff and Low (1974) concluded that although the WISC and the HRNB share a good deal of common variability, the HRNB appears to offer unique information. While of interest, the meaning of such findings for learning disabled children are not clear from these data.

Since global scores and individual subtests of the WISC-R have been shown to be among the best predictors of neuropsychological dysfunction (see Boll, 1974), one has good reason to question the degree to which the HRNB may offer unique information for learning disabled children. In light of the extensive time necessary for administration of the

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HRNB, such orthogonal information needs to be demonstrated. With these objectives in mind, the present investigation was designed to examine the overlap in constructs between the WISC-R and the HRNB for learning disabled children. In addition to providing information concerning the similarity of these measures, this study sought to further identify the underlying constructs measured by both batteries.

Method

Subjects

The subjects were 1181 children (885 males and 296 females) who were referred for psychological evaluations as a result of general learning problems in the regular classroom. Students ranged in age from 8 to 16 years ($\bar{X}$ = 11.02 years, SD = 1.86).

Procedure

Each subject was administered the regular 11 subtests of the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974) and the 9 tests of the Halstead-Reitan Neuropsychological Battery (Reitan, 1969) by experienced neuropsychological examiners. Subtest scores of the WISC-R and HRNB were related using a canonical correlation and the underlying factor structure was examined.

Results and Discussion

Means and standard deviations of the WISC-R and HRNB are

Insert Table 1 about here

displayed in Table 1. Subjects of the WISC-R were related to measures of the HRNB using a canonical correlational analysis. The results yielded one significant correlation between linear components of the WISC-R and HRNB subtests ($R_c = .64$, $F(11,1159) = 73.17$, $p < .001$). The interpretable weights for the significant canonical correlation are shown in Table 1. In analyzing the resulting canonical variates, only weights of $\pm .2$ were considered large enough for interpretation. This analysis indicated a symmetrical redundancy. The present data indicate that the WISC-R and the HRNB share only approximately 10% of common variability. From an examination of canonical weights, this overlap seems attributable to an overlap in general cognitive reasoning inherent in each measure (Dean, 1983a, 1985). Such results suggest that while there is some overlap between the WISC-R and the HRNB, each measure appears to offer unique information.

In an effort to further evaluate the constructs shared by the WISC-R and the HRNB, a factor analysis was computed. The total correlation matrix was submitted to a principal-component analysis, and those factors with eigenvalues greater than 1.0 were rotated to a final varimax solution. The rotated factor loadings for all interpretable subtests/tests are reported in Table 2. When considering the individual subtests loadings, only weights of $\pm .3$ were seen as interpretable (see Nunnally, 1967).

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Consistent with Russell's (1982) findings using the adult version of the HRNB, a six factor solution emerged for the present data. Factor 1 seems similar to what Kaufman (1975, 1979) has labeled Verbal Comprehension.

Insert Table 2 about here

Factor 2 was rather unique, with major loadings on the Category Test, and both Dominant and Non-Dominant Finger Tapping. Additional minor loadings also emerged on the Seashore Rhythm and Speech Sounds Perception tests.

When considering Factor 2, it is important to note that the HRNB raw scores are not transformed to standard scores, because of a lack of well accepted age related norms. This being the case, Factor 2 seems best explained not by the constructs of each test (e.g., concept formation, motor speed, auditory discrimination), but by the developmental nature of these related tasks. In light of these data, Factor 2 was thought to be a compilation of Developmental Tasks.

Major loadings on Factor 3 were exhibited for the Picture Completion, Picture Arrangement, Block Design and Object Assembly subtests of the WISC-R. This loading is consistent with Swiercinsky and Howard's (1982) Spatial Reasoning factor and Russell's (1982) Figural Long Term Memory.

Consistent with Kaufman's (1975, 1979) research, Factor 4 was composed of measures requiring Sustained Attention,

mental flexibility, speed of processing, short term memory and what some investigators have called Freedom from Distractibility (Kaufman, 1975).

Reflecting further the findings of orthogonal information for the HRNB identified in the canonical correlational analysis, Factor 5 and 6 showed major loadings for the HRNB test and little overlap with the WISC-R. Basically, other than a minor loading on Picture Arrangement, both these factors were unique to the HRNB. Factor 5 seemed to reflect skills such as tactual discrimination, tactual integration, spatial memory, and visual-motor and conceptual-motor tracking. In fact, the most substantial loadings came on tasks requiring spatial manipulation with a significant time component.

Factor 6 was rather skill specific, relating principally to incidental and tactile memory tasks. Clearly, Spatial Memory characterizes this factor which was composed of TPT-memory and TPT-location, with a minor loading on Trail Making A.

In general, the present study is unique in that little published research exists concerning the factor structure of the HRNB with children. However, previous studies with adults offer some similarities. This consistency is noteworthy since most of these studies utilized adult measures (e.g., selected WAIS and HRNB subtests) with brain damaged adults (Russell, 1982, Swiercinsky & Howard, 1982). Moreover, the similarity between the six factors previously

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identified and our results are clear (Russell, 1982).

In the main, it is obvious from the present data that the WISC-R and the HRNB offer unique information concerning learning disabled children's functioning. Moreover, in light of the new information offered by the HRNB, the additional administration time may well be worthy of consideration.

References

- Black, F. W. (1976). Cognitive, academic and behavioral findings in children with suspected and documented neurological dysfunction. Journal of Learning Disabilities, 2, 182-187.
- Boll, T. J. (1974). Behavioral correlates of cerebral damage in children aged 9 through 14. In R. M. Reitan & L. A. Davison (Eds.), Clinical Neuropsychology: Current status and applications. (p. 91-120). New York: John Wiley.
- D'Amato, R. C., Dean, R. S. & Rattan, G. (1986). A Study of psychological learning problem referrals by grade level and gender. Manuscript submitted for publication.
- Dean, R. S. (1977). Canonical analysis of a jangle fallacy. Multivariate Experimental Clinical Research, 3, 17-20.
- Dean, R. S. (1982a). Providing psychological services to school age children. In G. D. Miller (Ed.), Differentiated levels of study support services: Crisis, remedial and developmental approaches (pp. 98-123). St. Paul, MN: Pupil Personnel Services, MN State Department of Education.
- Dean, R. S. (1982b). Neuropsychological assessment. In T. R. Kratochwill (Ed.), Advances in school psychology: Vol. 2. (pp. 171-201). Hillside, N. J.: Lawrence Erlbaum.
- Dean, R. S. (1983a). WISC-R Report of Individual Evaluation Manual. Odessa, FL: Psychological Assessment Resources.
- Dean, R. S. (1983b). Intelligence-achievement discrepancies in diagnosing pediatric learning disabilities. Clinical Neuropsychology, 3, 58-62.

- Dean, R. S. (1985). Neuropsychological assessment. In J. D. Cavenar, R. Michels, H. K. H. Brodie, A. M. Cooper, S. B. Guze, L. L. Judd, G. L. Klerman, & A. J. Solnit (Eds.), Psychiatry (pp. 1-16). Philadelphia, PA: Lippincott.
- Dean, R. S. (1986). Perspectives on the future of neuropsychological assessment. In B. S. Plake & J. C. Witt (Eds.), Buros--Nebraska series on measurement and testing: Future of testing and measurement. Hillsdale, N. J.: Lawrence Erlbaum.
- Diller, L., & Gordon, W. A. (1981). Rehabilitation and clinical neuropsychology. In S. B. Filskov & T. J. Boll (Eds.), Handbook of clinical neuropsychology (pp. 702-733). New York: Wiley.
- Fisk, J. L., & Rourke, B. P. (1979). Identification of subtypes of learning-disabled children at three age levels: A neuropsychological, multivariate approach. Journal of Clinical Neuropsychology, 1, 289-310.
- Gaddes, W. H. (1975). Neurological implications for learning. In W. M. Cruickshank & D. P. Hallahan (Eds.), Perceptual and learning disability in children: Vol.2. Syracuse: Syracuse University Press.
- Golden, C. J. (1978). Diagnosis and rehabilitation in clinical neuropsychology. Springfield, IL: Charles C. Thomas.
- Gunnison, J. A. (1984). Developing educational intervention from assessments involving the K-ABC. Journal of Special Education, 18, 325-344.

- Gunnison, J., Kaufman, N., & Kaufman, A. (1982). Reading remediation based on sequential and simultaneous processing. Academic Therapy, 17, 297-307.
- Hartlage, L. C. (1975). Neuropsychological approaches to predicting outcome of remedial education strategies for learning disabled children. Pediatric Psychology, 3, 23-28.
- Hartlage, L. C. & Lucas, D. G. (1973). Group screening for reading disability in first grade children. Journal of Learning Disabilities, 6, 48-52.
- Hynd, G. W. (Ed.). (1981). Neuropsychology in the schools [Special Issue]. School Psychology Review, 10.
- Hynd, G. W., & Obrzut, J. E. (Eds.). (1981). Neuropsychological assessment and the school-age child: Issues and procedures. New York: Grune & Stratton.
- Kaufman, A. S. (1975). Factor analysis of the WISC-R at 11 age levels between 6 1/2 and 16 1/2 years. Journal of Consulting and Clinical Psychology, 43, 135-147.
- Kaufman, A. S. (1979). Intelligent testing with the WISC-R. New York: John Wiley & Sons.
- Klonoff, H., Robinson G. C. & Thompson, G. (1969). Acute and chronic brain syndromes in children. Developmental Medicine and Child Neurology, 11, 198-213.
- Klonoff, H. & Low, M. (1974). Disordered brain function in young children and early adolescents: Neuropsychological and electroencephalographic correlates. In R. M. Reitan and L. A. Davison (Eds.), Clinical neuropsychology:

- Current status and applications (p. 121-165). New York: John Wiley & Sons.
- Luria, A. R. (1963). Restoration of function after brain injury. New York: MacMillan.
- Luria, A. R. (1966). Higher cortical functions in man. New York: Basic Books.
- Nicewander, W. A., & Wood, D. A. (1974). Comments on "a general canonical correlation index". Psychological Bulletin, 81, 92-94.
- Nunnally, J. C. (1967). Psychometric theory. New York: McGraw-Hill.
- Reitan, R. M. (1969). Manual for administration of neuropsychological test batteries for adults and children. Indianapolis, Indiana: Published by the author.
- Reynolds, C. R. (1981a). The fallacy of two years below grade level for age as a diagnostic criteria for reading disorders. Journal of School Psychology, 19, 350-358.
- Reynolds, C. R. (1981b). Neuropsychological assessment and the habilitation of learning: Considerations in the search for the aptitude x treatment interaction. School Psychology Review, 10, 343-349.
- Rourke, B. P. (1976). Issues in the neuropsychological assessment of children with learning disabilities. Canadian Psychological Review, 17, 89-102.
- Russell, E. W. (1982). Factor analysis of the Revised Wechsler Memory Scale tests in a neuropsychological battery. Perceptual and Motor Skills, 54, 971-974.

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- Stewart, D., & Love, W. A., (1968). A general canonical correlation index. Psychological Bulletin, 70, 160-163.
- Swiercinsky, D. P., & Hallenbeck, C. E. (1975). A factorial approach to neuropsychological assessment. Journal of Clinical Psychology, 31, 610-618.
- Swiercinsky, D. P., & Howard, M. e. (1982). Programmatic series of factor analyses for evaluating the structure of neuropsychological test batteries. Clinical Neuropsychology, 4, 147-152.
- Wechsler, D. (1974). Wechsler Intelligence Scale for Children-Revised. New York: Psychological Corporation.

Table 1

Means, Standard Deviations, and Canonical Weights
for the WISC-R and HRNB by Tests/Subtests

Tests/Subtests	Canonical Weights	$\bar{X}$	SD
<u>WISC-R</u>			
Information	-.230*	7.73	2.60
Similarities	-.169	9.12	2.97
Arithmetic	-.334*	7.54	2.28
Vocabulary	.292*	8.44	2.50
Comprehension	-.132	8.86	2.67
Digit Span	-.386*	7.44	2.43
Picture Completion	-.087	10.15	2.66
Picture Arrangement	-.251*	10.36	2.76
Block Design	-.286*	9.45	2.79
Object Assembly	-.199	10.21	3.20
Coding	-.158	8.63	3.01
Verbal IQ		89.37	12.12
Performance IQ		98.22	13.34
Full Scale IQ		92.95	11.49
<u>HRNB</u>			
TPT-Dominant Hand	.128	243.93	165.40
TPT-Non-Dominant Hand	.142	184.43	142.93
TPT-Memory	-.082	5.22	1.27
TPT-Location	-.187	4.31	1.75
Category Errors	.426*	52.63	18.35
Speech Sounds Perception	.225*	14.66	8.47
Seashore Rhythm Errors	-.265*	21.49	4.68
Trail Making A	.135	20.40	12.56
Trail Making B	.266*	55.37	40.27
Tapping-Dominant Hand	.025	31.95	7.26
Tapping-Non-Dominant Hand	.143	29.89	6.51
* Indicates interpretable weights			

Table 2

Factor Loadings of WISC-R and HRNB Tests/Subtests^a

Tests/Subtests	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
<u>WISC-R</u>						
Information	* .77					
Similarities	* .74					
Arithmetic	.47			* .51		
Vocabulary	* .85					
Comprehension	* .78					
Digit Span				* .63		
Picture Completion			* .61			
Picture Arrangement			* .51		- .31	
Block Design			* .78			
Object Assembly			* .80			
Coding				* .55		
<u>HRNB</u>						
TPT - Dominant Hand					* .72	
TPT - Non-Dominant Hand					* .73	
TPT - Memory						* .85
TPT - Location						* .82
Category Errors		* -.45				
Speech Sounds Perception		-.40		* -.55		
Seashore Rhythm Errors		* .47		.48		
Trail Making A				* -.37	.38	.34
Trail Making B				-.41	* .59	
Tapping - Dominant Hand		* .87				
Tapping -Non-Dominant Hand		* .87				
Age Months		* .72				
Eigenvalue	4.833	2.656	1.881	1.366	1.249	1.124

^a Only loadings of .30 or above are reported

* Indicates highest factor loadings